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It is safe to say that the law of variation in the diameter of the image of a star with varying times of exposure must be tested for each instrument used, since no two telescopes will ever have exactly the same form of focal image.

A uniformity in the kind of plate used is of course indispensable if a direct comparison is a desideratum.

J. M. SCHAEBERLE.

Mt. HAMILTON, July 27, 1891.

ERRATA IN THE SECOND ARMAGH CATALOGUE OF STARS.

Communicated by Dr. J. L. E. DREYER, Director of the
Armagh Observatory.

No. 178, *for* $10^{\circ}.61$ *read* $9^{\circ}.61$.

No. 770, *for* $9^{\circ}.88$ *read* $11^{\circ}.34$.

No. 1083, *for* $27^{\circ}.25$ *read* $28^{\circ}.25$.

No. 1102, *for* $32^{\circ}.62$ *read* $33^{\circ}.24$.

No. 1138, *dele* seconds of R. A., "Epoch" and "Obs."

The star was not observed in R. A.

No. 1138, in N. P. D. *for* $48'$ *read* $47'$.

No. 1531, in N. P. D. *for* $6'$ *read* $5'$.

Page 152. No. 1055 is ARG. XXXIII, the P. M. is according to ARGELANDER $-0^{\circ}.0141$, $+0''.100$.

Page 158. First column, *for* 1035 *read* 1435.

FOREST FIRES AT MOUNT HAMILTON, JULY, 1891.

[The following report to the Regents of the University of California may have some interest to others as a part of the history of the Lick Observatory.]

MOUNT HAMILTON, July 29, 1891.

HON. T. G. PHELPS, *Chairman L. O. Committee* :

DEAR SIR,—I beg to submit the following report on the forest fires of July 21 to July 28. I have asked Professor SCHAEBERLE to write this, as he was in charge of the Observatory for most of the time—but he prefers that I should give you this account.

The Observatory is at the summit of a rocky peak called Mt. Hamilton. Just north of it is a deep wide thickly wooded cañon—*Cañon Negro*—and the mountain *Galileo* is on the other side of this cañon, about 4500 feet distant. The whole object was to keep the fire from reaching the chapparal in this cañon. It could enter in two ways; either by passing down the cañon north of *Galileo* (in which the *Joaquin Spring* is situated) and down the cañon of

Isabel Creek, thus beginning to burn from the bottom of *Cañon Negro*; or it could enter over the summits of the other mountain crests (*Copernicus*, *Galileo*, *Kepler*) which are above the cañon on its north and east sides.

If it *had* entered, it is probable that the greater part of the chapparal in *Cañon Negro* would have burned, and the cottages of Professor BARNARD, McDONALD and FRASER together with the Barn, Coast Survey House, Engine House, etc., would have been in the greatest danger.

I do not think the Lick Observatory was at any time in jeopardy. Perhaps it is worth while to put on record that one of the very first things done at the Lick Observatory, under the authority of the Regents, early in 1888, was to cut down the chaparral in the neighborhood of the cottages, a month having been spent in this work.

The first fire discovered was more than a mile east of the Observatory, beyond these crests, near the land of Mr. MORROW; and Tuesday (July 21), Wednesday (July 22) and Thursday (July 23) were spent in confining the fire to the slopes east of these crests. This was successfully accomplished by the astronomers and workmen of the Observatory, led by Professor SCHAEBERLE.

It was, however, only accomplished with extreme difficulty and by the severest personal exertions. Professor SCHAEBERLE, for example, was constantly at work for three days and two nights and he was seconded by our astronomers and workmen and by Professor TAYLOR, of the University of the State of Washington (a special student at the Lick Observatory).*

On Monday evening, July 20, two men stopped at the Smith Creek Hotel and then proceeded onwards toward the San Antonio Valley, along the county road leading east from Mt. Hamilton. The men passed WANDELL'S ranche, about one mile north-east of the Observatory, some time about midnight of Monday, and it is believed that they made a camp somewhere between his place and that of Mr. ERKSON, and that the fire was accidentally started by them.

About 7 A. M. of Tuesday, July 21, WANDELL discovered a brisk forest fire near him, and proceeded to put it out. Finding it more serious than he expected he sent word to the L. O. that

* MESSRS. HOLDEN, BURNHAM and BARNARD were unfortunately absent from Mt. Hamilton, on official business, till Thursday, July 23.

he needed help, and the laborer (KING) was sent to assist. In the afternoon the fire increased and all the astronomers and workmen present at the Observatory went to aid in the work under the direction of Professor SCHAEBERLE.

The fire extended over the nearer parts of Mr. R. F. MORROW'S ranche and had entered on the L. O. Reservation by 2 A. M.

The fire increased during the night of Tuesday, and at 7 A. M. of Wednesday, July 22, it was near the high service reservoir (*Copernicus*) towards the east.

I returned to San José at 7 P. M. of July 22 and, learning of the fire, at once drove to Smith Creek, arriving at 11.20 P. M. After hearing from the Observatory by telephone I did not think it necessary to come to the Observatory that night, but I arrived early on the morning of Thursday, July 23. Messrs. BURNHAM and BARNARD arrived by the noon stage of that day, and at once went to the scene of the fire. It had not yet been possible to obtain men to aid in fighting the fire, although Prof. SCHAEBERLE had telephoned for them; and the astronomers of the L. O. with the workmen, continued their severe work. During the forenoon the fire was successfully beaten back from the crest of the slope joining *Copernicus* and *Hipparchus*. In the afternoon there was great danger that it would cross the crest running north from *Copernicus* towards *Newton*. This was prevented by cutting a trail some six feet broad from the reservoir northwards; the work being done by the astronomers and the L. O. workmen under Professor SCHAEBERLE'S direction. By very severe exertions the fire was stopped at this trail and thus was prevented from entering the cañon next to the L. O. and the beautiful grove on the northwest slope of *Copernicus* was saved.

On Thursday night the fire was kept north of MORROW'S old trail, and it filled the cañon east of *Newton* (the *Joaquin Spring* cañon) and burned over towards STEIGER'S ranche on the *Isabel Creek*. On Thursday evening laborers were obtained in San José and six men arrived at 4 A. M. Friday, and went to work at once—the astronomers leaving the work after three days and nights of nearly continuous labor.

On Friday night the fire was pretty well confined to the *Joaquin Spring* country and seemed to be under control. On Saturday morning a plowed road was made from the end of WANDELL'S wood road along the east flank of *Galileo*—across the saddle between *Galileo* and *Copernicus*—to keep the fire

from entering our cañon from the north directly from the Joaquin. On Saturday noon all the extra workmen but one were sent back to San José. He was kept to cut chapparal and to watch the fire at night. We were aided by our neighbors Messrs. WANDELL, LUNDY and KINCAID with their workmen on Friday and Saturday. On Sunday morning an inspection by myself showed an increase of fire in the *Joaquin* cañon and a danger that the fire would work into *Cañon Negro* round the *Isabel Cañon* and the west ridge of *Galileo*. Accordingly I asked Mr. WANDELL to aid our own workmen, and all were set to work on Sunday noon. On Monday morning about 11 o'clock the fire was so severe that all the astronomers again turned out and after a most laborious and exciting day succeeded in restricting the fire to the cañon north of *Galileo* (the cañon of *Joaquin Spring*).

Assistance was again sent for and seven men arrived from Mr. KINCAID'S, and during the night seven or eight more men from BERNAL'S, and by Tuesday morning the fire was confined between the Isabel Creek on the north and spaces which had been burned over. Long trails were cut and back-fires set whenever necessary and at the present writing (July 29) it appears that the fire is entirely isolated. If it should enter the cañon just north of the Observatory (*Cañon Negro*) there is no way to stop it until it reaches the road to the Springs just below the wooden cottages. Accordingly this road is now being widened by felling the chapparal so as to protect the dwellings, the stables and our stock of hay and fuel.

The experience has been a novel one to all of us. Some idea of the force of the fire may be had by recalling the fact that all the chapparal on a steep hillside was completely burned up in 12 minutes; the area burned over being at least 240,000 square feet. At one time the astronomers were obliged to defend a crest something like a half a mile long, and to prevent the flames from crossing it while the fire was burning fiercely along the whole line. The flames rose 30, 40 or even 50 feet in the air, making a terrific heat, which had to be faced. If the fire is not stopped on the *farther* side of such a crest but is allowed to cross the ridge, the *hither* slope is sure to be fired by the pine cones which, once lighted, cannot be put out and which roll down the hither slope igniting everything they touch. Every leaf and tree is like tinder in the midst of our long summer and burns freely. No water was available for extinguishing this fire and dirt had to be shovelled

on to the flames instead. The water in the reservoirs is necessary to our daily life; and moreover it had to be carefully saved in case of possible danger to the Observatory itself.

It would not be proper for me to close this account without a formal recognition of the really splendid service rendered to the Observatory by our astronomers and men. Every one on the Reservation was employed. Even the children made long trips carrying water and provisions; and the ladies with the servants saw to it that food was provided for those who were fighting the fire.

I beg leave to call your attention to the fact that experiences of this kind are not included in the lives of the members of the Faculties of the Universities of California. It is said that there were seven Professors of Sanskrit in the armies before Metz. I do not know how much they contributed to its fall, but I am sure that our astronomical corps has saved a vast deal of property to the University—including our pumping engine, all the buildings at the foot of the Observatory hill and many hundred acres of timbered land.

I am, dear Sir,

Very respectfully and truly yours,

EDWARD S. HOLDEN.

SCIENTIFIC VISITORS TO THE LICK OBSERVATORY.

We have lately had the pleasure of receiving at Mt. Hamilton Dr. DAVID STARR JORDAN, President of the Stanford University, in company with Professor GEORGE CHRYSTAL, F. R. S., who was making a flying visit to California.

Professor MICHELSON, of Clark University, Worcester, Massachusetts, is making a prolonged stay at the Observatory in order to try the experiments which are described in his paper in the present number of the *Publications*. E. S. H.

ATMOSPHERIC ABSORPTION OF THE PHOTOGRAPHIC RAYS.

In an investigation for determining the law of the atmospheric absorption of the photographic rays of light I have deduced the following empirical formula for expressing the brightness of a star at any zenith-distance in terms of the brightness which the star would have, theoretically, at the zenith-distance zero,

$$B = B_0 \left[1 - f \cdot \tan \left(\left(\frac{z}{12} \right)^2 \right) \right]$$